Complete Summary

GUIDELINE TITLE

Evidence based clinical practice guideline for emergency appendectomy.

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Evidence based clinical practice guideline for emergency appendectomy. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2002 Oct. 9 p. [81 references]

COMPLETE SUMMARY CONTENT

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SCOPE

DISEASE/CONDITION(S)

Emergency appendectomy

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Treatment

CLINICAL SPECIALTY

Emergency Medicine
Family Practice
Pediatrics
Surgery

INTENDED USERS

Advanced Practice Nurses
Health Care Providers
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

- To optimize rapid accurate diagnosis and treatment of acute appendicitis
- To decrease the use of unnecessary diagnostics and therapies
- To reduce length of stay
- To maintain or improve family satisfaction

TARGET POPULATION

Children 3 to 21 years of age with signs/symptoms or diagnostic findings indicative of appendicitis

These guidelines are not intended to be used in the following:

- Children aged less than 3 years or >21 years
- Children with previous appendectomy
- Children with history of bloody stools
- Children with history of CF, Crohn's disease, transplant, malignancy, or chronic appendicitis requiring interval appendectomy
- Children admitted for observation

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Assessment

1. Clinical exam performed expeditiously by an experienced physician in patients presenting with acute abdominal pain and tenderness
2. Laboratory studies (not routinely recommended)
3. Diagnostic imaging (not routinely recommended)

Management/Treatment

1. Preoperative antibiotics, including intravenous cefotetan; ampicillin/sulbactam (Unasyn®) combined with gentamicin; piperacillin/tazobactam (Zosyn®); or vancomycin + clindamycin + gentamicin (for penicillin-allergic patients)
2. Avoidance of pain medications prior to surgical consult
3. Operative management, including prevention of postoperative emesis through use of ondansetron (Zofran®), primary skin closure or delayed primary closure of the wound, open or closed appendectomy, wound infiltration with local anesthetic (i.e., bupivicaine)
4. Postoperative feeding
5. Postoperative pain management (intravenous morphine, augmented by ketorolac; for less severe pain, acetaminophen or ibuprofen; patient-controlled analgesia in children over 7 years of age)

6. Postoperative antibiotics, including ampicillin/sulbactam (Unasyn®) combined with gentamicin, or piperacillin/tazobactam (Zosyn®), or vancomycin + clindamycin + gentamicin (for penicillin-allergic patients)
7. Respiratory care, including incentive spirometry
8. Patient/family education
9. Discharge criteria

MAJOR OUTCOMES CONSIDERED

Postoperative complications, including wound infections and respiratory complications

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic and critical literature reviews, using a grading scale, and examined current local clinical practices.

During formulation of these guidelines, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The guidelines have been reviewed and approved by clinical experts not involved in the development process, senior management, Risk Management & Corporate Compliance, the Institutional Review Board, other appropriate hospital committees, and other individuals as appropriate to their intended purposes.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Each recommendation is followed by evidence grades (A-X) identifying the type of supporting evidence. Definitions of the evidence grades are presented at the end of the "Major Recommendations" field.

<u>Preoperative Management</u>

The diagnosis of acute appendicitis is difficult to make, especially in young children. Many illnesses have similar initial presentations. In addition, there is a greater risk of complications the longer definitive diagnosis is delayed. The diagnosis of appendicitis is best made by the expeditious clinical exam of an experienced physician.

1. It is recommended that the diagnosis of acute appendicitis be considered in any pediatric patient presenting with acute abdominal pain and tenderness (Nance, Adamson, & Hedrick, 2000 [D]).

Note 1: Appendicitis is manifested by a constellation of signs/symptoms including fever, anorexia, nausea, vomiting, migratory right iliac fossa pain, right lower quadrant abdominal pain, abdominal tenderness and guarding, and signs of peritoneal irritation. No single sign or symptom nor combination thereof has been shown to be predictive of acute appendicitis in children (Reynolds & Jaffe, 1992 [D]; Ein, 2000 [S]).

Note 2: Vomiting, right lower quadrant pain, abdominal tenderness, and guarding are individually loosely associated with appendicitis. The presence of any two of these has a strong predictability for diagnosing acute appendicitis (Reynolds & Jaffe, 1992 [D]).

Note 3: Many presenting signs/symptoms are age dependent. For example, diarrhea and abdominal pain are more common in children two to five years of age. Preschool children are usually unable to report a history of pain migration; therefore, generalized pain is more likely to be part of the presenting picture in younger children. (Horwitz et al., 1997 [D]; Barker & Davey, 1988 [D]; Rasmussen & Hoffmann, 1991 [S]) School age children are more likely to describe the onset of centrally located pain with migration to the right lower quadrant (RLQ) and have signs of peritoneal irritation (Cappendijk & Hazebroek, 2000 [D];, Rasmussen & Hoffmann, 1991 [S]).

Laboratory Assessment

1. Routine use of laboratory studies is not recommended. No single laboratory study or combination of studies has been found to be predictive of acute appendicitis in the pediatric population.

   Note: The white blood count (WBC) is elevated in 87 to 92% of patients with acute appendicitis. However, it can also be elevated in many other abdominal conditions (Hale et al., 1997 [D]; Pearl et al. 1995 [D]; Ramirez & Deus, 1994 [D]; Harland, 1991 [D]). Since 8 to 13% of patients with appendicitis will have a normal WBC, a normal WBC does not rule out appendicitis (Hale et al., 1997 [D]; Pearl et al., 1995 [D]; Ramirez & Deus, 1994 [D], Harland, 1991 [D]).

2. In patients with equivocal histories and physical examinations, the use of laboratory studies (e.g., complete blood count, urinalysis) may be useful in including or excluding other possible diagnoses. Since physical exam is particularly unreliable in females of reproductive age (Graff et al., 2000 [D]), the use of urinalysis and urine pregnancy test is a reasonable clinical strategy to exclude genitourinary pathology.

Radiologic Assessment

1. Diagnostic imaging is not routinely recommended when there is either a high or low probability of appendicitis. Imaging infrequently alters management in cases with a very high or very low clinical likelihood of appendicitis (Orr, Porter, & Hartman, 1995 [M]; Teo et al., 2000 [C]) and is not cost-effective in these patient populations (Orr, Porter, & Hartman, 1995 [M}; Teo et al., 2000 [C], Lessin et al.,1999 [C], Sivit et al., 1992 [C]; Crady et al., 1993 [D]; Axelrod, Sonnad, & Hirschl, 2000 [Q]).

2. Diagnostic imaging is most helpful when the clinical assessment is equivocal.

Antibiotics

Infectious complications related to appendicitis include intra-abdominal abscesses, peritonitis, and wound infection. Wound infection is the most common source of morbidity after appendectomy. Rates of postoperative wound infection vary between 6 to 50% based primarily on antibiotic coverage and perforated versus nonperforated appendicitis. Prior to the use of antibiotics, postoperative wound infection following appendectomy for perforated appendicitis was as high as 70% (Schwartz, Tapper, & Solenberger, 1983 [C]; Bower, Bell, & Ternberg, 1981 [D]). Multiple studies have demonstrated that routine use of antibiotics can decrease the risk of postoperative complications in patients with appendicitis (Murao, Ueda, & Miyamoto, 1996 [B]; Tsang, Tam, & Saing, 1992 [B]; Meller et al., 1991 [B]; Fishman et al., 2000 [C]; Koch et al., 2000 [C]). Despite several studies, including randomized clinical trials of different antibiotic regimens, there appears to be no clear advantage to any particular combination of antibiotics on postsurgical wound infection rates. In an effort to decrease antibiotic resistance, the narrowest spectrum of antibiotics to achieve adequate coverage for the most common organisms and a limited duration of therapy should be considered (Dever & Dermody, 1991 [S]).

1. It is recommended that preoperative antibiotics be used routinely and as soon as possible after presentation in all patients with appendicitis (Soderquist-Elinder et al., 1995 [A]; Tsang, Tam, & Saing, 1992 [B]; el-Mufti et al., 1989 [B]; Lund & Murphy, 1994 [C]; Browder et al.,1989 [C]; Kaplan, 1998 [S]).

   Note 1: When non-perforated appendicitis is suspected, it is recommended that cefotetan 20 mg/kg be given intravenously (Formulary, 2002; Mosdell, Morris, & Fry, 1994 [D]).

   Note 2: When perforated appendicitis is suspected preoperatively, the evidence to support the use of any particular antibiotic or combination of antibiotics is not strong. Single agent, very broad spectrum antibiotics may provide effective coverage but may also increase the risk of appearance of organisms resistant to multiple antibiotics. Use of more than one antibiotic in the same patient requires multiple drug administrations, possibly with more patient discomfort and greater risk of error. Ampicillin/sulbactam (Unasyn®) 75 mg/kg/dose given every six hours along with gentamicin 2.5 mg/kg given every eight hours OR piperacillin/tazobactam (Zosyn®) 100mg/kg/dose given alone every six hours are in common use currently and probably have similar benefit/safety profiles (Formulary, 2002; Ciftci et al., 1997 [A]; Hopkins, Wilson, & Bobey, 1994 [A], Mosdell, Morris, & Fry, 1994 [D]; Jhee et al., 1995 [S]; Dever & Dermody, 1991 [S]; Bohnen et al., 1992 [E]).

   Note 3: For penicillin-allergic patients with suspected perforated appendicitis, it is recommended that vancomycin 15mg/kg/dose every eight hours plus clindamycin 10mg/kg/dose every eight hours plus gentamicin 2.5mg/kg/dose every eight hours be used (Formulary, 2002; Mosdell, Morris, & Fry, 1994 [D]).

Pain Management

1. It is important that pain medications not be given prior to a careful examination by the surgeon consulted to treat the patient. Pain may then be managed by the administration of intravenous (IV) morphine (0.1-0.15 mg/kg) every 2 hours as needed. (Haberkern, Tyler, & Krane, 1991 [S]; Berde, 1989 [S])

Operative Management

Elements of operative management include prevention of postoperative emesis, skin preparation, appendectomy, removal of any fecolith present within the peritoneum, removal of all grossly contaminated fluid from the peritoneal cavity, appropriate closure of the appendiceal base, musculofascial closure of the abdominal wall, and pain management.

1. Upon induction of anesthesia, it is recommended that ondansetron (Zofran®) (50 mcg/kg/dose) be administered intravenously to prevent postoperative emesis (Watcha, Cieslak, & Pennant, 1995 [B]; Davis et al., 1995 [B]; Ummenhofer et al., 1994 [B]).
2. In most cases, primary skin closure is appropriate. In cases where primary skin closure is deemed inappropriate secondary to widespread infection within the peritoneal cavity, delayed primary closure of the wound is recommended (Cohn et al., 2001 [B]; Serour et al., 1996 [C]).
3. It is recommended that the senior surgeon individualize the role of limited versus extensive irrigation of the peritoneum, subcutaneous tissue, and the nature of the skin closure (interrupted versus subcuticular running). No specific information is present which would support one therapeutic route compared to others (Local expert consensus [E]).
4. It is recommended that the primary mode of surgical exploration and appendectomy (open versus laparoscopic) be a "surgeon's choice." Equivalent success and complication risk are seen following both procedures. (Chung et al., 1999 [M]; Long et al., 2001 [A]; Hansen et al., 1996 [A]; Frazee et al., 1994 [A]; Minne et al., 1997 [B]).
5. The routine, intraoperative culture of peritoneal fluid is not recommended (Bilik, Burnweit, & Shandling, 1998 [C]; Kokoska et al., 1999 [D]).
6. For nonperforated appendicitis, it is recommended that the incision be infiltrated with a local anesthetic (i.e., bupivicaine 0.25% up to 2.5mg/kg total dose) at the conclusion of the surgical procedure. Wound infiltration with local anesthetic has been shown to decrease postoperative analgesic requirements (Wright, 1993 [C]; Goldschneider, Mancuso, & Berde, 2001 [S]; Dalens, 1995 [S]).

Postoperative Management

Feeding

1. Following nonperforated acute appendicitis, it is recommended that postoperative feeding be instituted after the effects of anesthesia have resolved.

   Note: Feeding after perforated appendicitis may be instituted when any ileus/bowel obstruction secondary to the perforation has resolved as indicated

by flat, soft abdomen and the presence of flatulence (Local expert consensus, [E]).

Pain Management

1. It is recommended that pain is routinely assessed (Nutting, 1992; Salantera et al., 1999 [C]) using age appropriate, validated pain assessment tools. (Local expert consensus [E]).

   Note: Valuable information regarding pain management may also be obtained through the measurement of physiologic changes, behavioral observation, and caregiver/parental input (Finley & McGrath, 1998 [S]).

2. For both perforated and nonperforated appendectomy, pain may be managed by the administration of IV morphine (0.1--0.15 mg/kg) every 2 hours as needed. (Haberkern, Tyler, & Krane, 1991 [S]; Berde, 1989 [S]). Pain management may also be augmented by the administration of ketorolac 0.5 mg/kg/dose (Maximum dose 15 mg/dose) intravenously every 6 hours (Buck, 1994 [C]; Local Expert Consensus [E]).
3. For pain that is less severe, acetaminophen (15--20 mg/kg) may be administered by mouth every 4 to 6 hours. In patients with acetaminophen allergy, ibuprofen (4--10mg/kg/dose every six to eight hours) may be employed (Cincinnati Children's Hospital Medical Ctr, 2002 [S]).
4. Following perforated appendix removal, the use of patient controlled analgesia (PCA) pumps is recommended in children >7 years of age (Doyle et al., 1994 [B]; Doyle, Robinson, & Morton, 1993 [B], Till et al.,1996 [C], Wright, 1993 [C]).

   Note: For children <7 years of age, the nurse may administer analgesia through the PCA pump (Local Expert Consensus [E]).

Antibiotics

1. For perforated appendicitis, it is recommended that ampicillin/sulbactam (Unasyn®) 75 mg/kg/dose be given every six hours along with gentamicin 2.5 mg/kg given every eight hours OR piperacillin/tazobactam (Zosyn®) 100mg/kg/dose be given alone every six hours. Antibiotics are discontinued once the patient is afebrile, tolerating a regular diet and demonstrates a normal WBC count (<10,000) without shift to band neutrophils (Hoelzer, Zabel, & Zern, 1999 [D]).

   Note 1: Escherichia coli and Bacteroides fragilis are the two organisms most commonly associated with perforated appendix (Meller et al., 1991 [B]; Arguedas et al., 1996 [C]; Rodriguez et al., 2000 [D]; Kokoska et al., 1999 [D]; Mosdell, Morris, & Fry, 1994 [D]).

   Note 2: Adjust gentamicin doses based on serum concentrations drawn around the third gentamicin dose (Siber et al., 1975 [C]).

   Note 3: For penicillin-allergic patients with perforated appendicitis, it is recommended that vancomycin 15mg/kg/dose every eight hours plus

clindamycin 10mg/kg/dose every eight hours plus gentamicin 2.5mg/kg/dose every eight hours be used (Formulary, 2002; Mosdell, Morris, & Fry, 1994 [D]).

2. For nonperforated appendicitis, it is recommended that one dose of cefotetan 20mg/kg be given IV 12 hours after the last preoperative dose (Local Expert Consensus [E]).

Respiratory Care

Respiratory complications, including fever, atelectasis, pneumonia, and respiratory failure are frequent causes of postoperative morbidity and mortality following major abdominal surgery (American Association for Respiratory Care [AARC], 1991).

1. Incentive spirometry (five to ten breaths per session) is recommended hourly, while awake, during the first 48 to 72 hours post extubation.

Patient/Family Education

1. It is recommended that education for the patient and family:
    - Begin upon admission and continue throughout the hospital course
    - Be geared to the developmental age of the patient and the learning abilities of the family/caregivers
    - Promote understanding of care of the child after discharge and activity alterations (Cuddy, 1986 [O]; Shesser & Kling, 1986 [O])
    - Address relevant topics including treatment plan, pain management, antibiotic administration, incision care, signs and symptoms of infection, when to return to school/daycare, and need for follow-up appointment

Discharge Criteria

1. For children with uncomplicated, nonperforated appendicitis, it is recommended that discharge be considered once the child has recovered from anesthesia, is afebrile, tolerates diet, and achieves adequate pain control on oral medication (Local expert consensus [E]).
2. For children with perforated appendicitis, it is recommended that discharge be considered once the child is afebrile for 24 hours, tolerates a regular diet, achieves adequate pain control on oral medications, and has suitable home environment to assure post-operative antibiotic administration (Local expert consensus [E]).

Definitions:

Evidence Based Grading Scale:

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis

E: Expert opinion or consensus
F: Basic laboratory research
S: Review article
M: Meta-analysis
Q: Decision analysis
L: Legal requirement
O: Other evidence
X: No evidence

CLINICAL ALGORITHM(S)

A diagnostic appendicitis algorithm is provided in the original guideline document.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence is identified and classified for each recommendation (see "Major Recommendations") using the following scheme:

Evidence Based Grading Scale:

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
E: Expert opinion or consensus
F: Basic laboratory research
S: Review article
M: Meta-analysis
Q: Decision analysis
L: Legal requirement
O: Other evidence
X: No evidence

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate medical treatment for emergency appendectomy as demonstrated by:

- Rapid, accurate diagnosis and treatment of acute appendicitis
- Decrease in the use of unnecessary diagnostics and therapies
- Reduced length of stay
- Maintained or improved family satisfaction

Prior to the use of antibiotics, postoperative wound infection following appendectomy for perforated appendicitis was as high as 70%. Multiple studies have demonstrated that routine use of antibiotics can decrease the risk of postoperative complications in patients with appendicitis.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

These recommendations result from review of literature and practices current at the time of their formulations. This protocol does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the guidelines to meet the specific and unique requirements of individual patients. Adherence to this pathway is voluntary. The physician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Appropriate companion documents have been developed to assist in the effective dissemination and implementation of the guideline.

The implementation process for each Cincinnati Children's Hospital Medical Center (CCHMC) guideline is a phase in a larger process of Guideline Development. This process is utilized for every guideline but is not addressed in the content of every guideline.

At the start of each guideline, a projected implementation date is determined. Reservations for education are then made (Grand Rounds, Patient Services Inservices). When the guideline is complete and enters into the Approval Process, Education planning begins. Changes created by the guideline are outlined as well as anticipated outcomes. The implementation date is confirmed. Education is provided. The guideline is implemented and pilot information collection started. The Guideline Coordinator makes daily rounds and eligible children are followed to document the use of the guideline. The implementation phase aids in finding areas for improvement or question. When issues identified are improved, the guideline progresses to the monitoring phase.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness
Safety
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Evidence based clinical practice guideline for emergency appendectomy. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2002 Oct. 9 p. [81 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2002 Oct

GUIDELINE DEVELOPER(S)

Cincinnati Children's Hospital Medical Center - Hospital/Medical Center

SOURCE(S) OF FUNDING

Cincinnati Children's Hospital Medical Center

GUIDELINE COMMITTEE

Clinical Effectiveness Team for Appendectomy

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the Cincinnati Children's Hospital Medical Center Web site.

For information regarding the full-text guideline, print copies, or evidence-based practice support services contact the Children's Hospital Medical Center Health Policy and Clinical Effectiveness Department at HPCEInfo@chmcc.org.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on March 11, 2004.

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